

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

SCP-110

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)

09/980154

INTERNATIONAL APPLICATION NO.  
PCT/CR99/00001INTERNATIONAL FILING DATE  
19 November 1999PRIORITY DATE CLAIMED  
28 May 1999

## TITLE OF INVENTION

## PREFABRICATED BIOLOGICAL PURIFICATION SYSTEM

## APPLICANT(S) FOR DO/EO/US

Luigi BRUSO et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

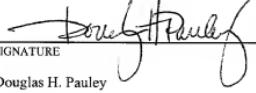
1.  This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2.  This is a **SECOND OR SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3.  This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4.  A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5.  A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a.  is transmitted herewith (required only if not transmitted by the International Bureau).
  - b.  has been transmitted by the International Bureau.
  - c.  is not required, as the application was filed in the United States Receiving Office (RO/US).
6.  A translation of the International Application into English (35 U.S.C. 371(c)(2)), including a translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
7.  Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a.  are transmitted herewith (required only if not transmitted by the International Bureau).
  - b.  have been transmitted by the International Bureau.
  - c.  have not been made; however, the time limit for making such amendments has NOT expired.
  - d.  have not been made and will not be made.
8.  A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9.  An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10.  A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11.  An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12.  An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13.  A **FIRST** preliminary amendment. (12 pages)  
 A **SECOND** or **SUBSEQUENT** preliminary amendment.
14.  A substitute specification. (attached to a red-ink marked-up version of the English language translation)
15.  A change of power of attorney and/or address letter.
16.  Other items or information:
  - Transmittal of Substitute Specification
  - Certificate of Mailing by Express Mail (2 pages)
  - Return Receipt Postcard

EXPRESS MAIL NO.: EL859246487US

MAILED: 28 November 2001

U.S. APPLICATION NO. (if known, see 37 CFR 1.50) <b>09/980154</b>	INTERNATIONAL APPLICATION NO. PCT/CR99/00001	ATTORNEY'S DOCKET NUMBER SCP-110
<p>17. <input checked="" type="checkbox"/> The following fees are submitted:</p> <p><b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):</b></p> <p>Search Report has been prepared by the EPO or JPO ..... \$ 890.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... \$ 710.00</p> <p>No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... \$ 740.00</p> <p>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$ 1,040.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... \$ 100.00</p>		<b>CALCULATIONS</b> PTO USE ONLY
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>		\$ 890.00
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		
CLAIMS	NUMBER FILED	NUMBER EXTRA
Total claims	10* - 20 =	0
Independent claims	1* - 03 =	0
MULTIPLE DEPENDENT CLAIM(S) (if applicable)		+ \$280.00
<b>TOTAL OF ABOVE CALCULATIONS =</b>		\$ 890.00
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).		
<b>SUBTOTAL =</b>		\$ 890.00
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).		
<b>TOTAL NATIONAL FEE =</b>		\$ 890.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property		
<b>TOTAL FEES ENCLOSED =</b>		\$ 890.00
<input type="checkbox"/> * Based upon entry of the First Preliminary Amendment.		Amount to be: refunded charged
		\$
a. <input checked="" type="checkbox"/>	A check in the amount of \$ <u>890.00</u> to cover the above fee is enclosed.	
b. <input type="checkbox"/>	Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.	
c. <input checked="" type="checkbox"/>	The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>19-3550</u> . A duplicate copy of this sheet is enclosed.	
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.		
		SIGNATURE
Douglas H. Pauley		
NAME		
33,295		REGISTRATION NUMBER

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Luigi BRUSO  
Pier Enrico BRUSO

Title: PREFABRICATED BIOLOGICAL  
PURIFICATION SYSTEM

Based Upon: PCT/CR99/00001

Express Mail No.: EL859246487US

Date of Deposit: 28 November 2001

**FIRST PRELIMINARY AMENDMENT****Box PCT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Please amend the subject application as follows to place this Patent

Application in better condition for examination:

In the claims, substitute the following Claims 1-5 (Amended) for the  
pending Claims 1-5 of the PCT Article 36 Amendment:

1. (Amended) In a prefabricated biological purification system  
for treatment of residential wastewater, the system having two main units including  
a primary purification unit having modular elements of an elongated octagonal shape  
and assembled one on top of the other, wherein the modular elements form a container

which varies in height depending on a number of the modular elements assembled, internal elements having an inflow tube, an internal separation panel with a fluid passage duct, a trapezoidal diaphragm, and a device for controlling liquid outflow and the container with an octagonal cover, the internal modifications to the primary purification unit comprising:

- (a) the internal separation panel having a first reduced height;
- (b) a diaphragm in a form of an octagonal modular element positioned approximately in a middle of the container;
- (c) a horizontal fluid passage duct formed as a horizontal opening of 5 cm between the separation panel and the diaphragm; and
- (d) an intake space of a flow control device having a second reduced height.

2. (Amended) In the prefabricated biological purification system according to Claim 1, wherein a secondary purification unit of the two main units comprises: panels of various shapes assembled to form an external structure; four triangular pieces and one central octagonal piece forming a bottom element; four L-shaped pieces with holes in corner areas for a vent tube to pass through which

together form an intermediate structure holding the panels together; and a one-piece compact fluid distributor.

3. (Amended) In the prefabricated biological purification system according to Claim 2, wherein the one-piece compact fluid distributor, prefabricated from concrete, requires no machinery for operation, and has an intake port in an upper central portion, a vent port in an upper section, and fluid distribution holes in a lower section.

4. (Amended) In the prefabricated biological purification system according to Claim 1, wherein an internal variation to the primary purifying unit has a horizontal fluid passageway positionable at different levels inside the container, depending on a capacity of the container and of a diaphragm constructed from an elongated octagonal element and separation panel perpendicular to the elongated octagonal element, with an opening between the two elements that permits internal passage of fluid from one sector to another.

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5. (Amended) In the prefabricated biological purification system according to claim 1, wherein complementary internal elements of the biological wastewater purification system include a lower diaphragm, the separation panel with the fluid passage duct, the flow control element, and a one-piece fluid distributor.

Please add the following new claims:

6. In the prefabricated biological purification system according to Claim 1, wherein each of the modular elements has the elongated octagonal shape of 81 cm x 101 cm at a base and 51 cm in height.

7. In the prefabricated biological purification system according to Claim 1, wherein the primary purification unit is a Prefabricated Biological Dupurator.

8. In the prefabricated biological purification system according to Claim 1, wherein an external modification to the primary purification unit includes placement of soapy water inlet points on both sides of the upper element corresponding to a second internal sector.

9. In the prefabricated biological purification system according to Claim 1, wherein the system has a secondary purifying unit comprising several prefabricated concrete panels and respective upper and lower connecting elements and a fluid distributor, and system components are modular.

10. In the prefabricated biological purification system according to Claim 1, wherein a one-piece compact fluid distributor, prefabricated from concrete, requires no machinery for operation, and has an intake port in an upper central portion, a vent port in an upper section, and fluid distribution holes in a lower section.

On a separate page, please add the following: **ABSTRACT OF THE DISCLOSURE.**

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**--ABSTRACT OF THE DISCLOSURE**

A prefabricated biological purification system which is a complete facility for the purification of domestic wastewaters and forms part of the technological field of civil engineering, more particularly, the field of black water treatment systems. The purification system is very versatile and can be used in different types of constructions, such as individual homes, condominiums, buildings, towns, and the like, including a unitary facility or multiple facilities depending on requirements. The prefabricated biological purification system has two basic units including two containers whose size varies depending on the type and equipped with all modular elements, bottom, walls and lids, in addition to all complementary internal elements. The shape of all components makes them easy to handle, transport and assemble and no special machinery or skilled labor is required. The system operates as follows: in the first unit, which is a prefabricated biological purifier that includes internal and external variations for optimized operation, the first and most important purification phase is effected, wherein the black waters are treated in three successive phases involving aerobic and anaerobic fermentation and decanting. It is possible to internally recirculate the sludges and the effluent of the purifier enters the second unit where it is evenly distributed by a liquid distributor. Purification is completed in the unit by oxidation of contaminating matters as a result of a bacterial film that covers

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Based Upon: PCT/CR99/00001

the filling material. A successive aerobic and partly anaerobic fermentation phase is carried out in the unit. The effluent of the system can be emptied into a receptacle involving no further treatment. In view of the fact that the prefabricated biological purification system does not produce any sludges, no regular maintenance or cleaning is required. There are no operating costs due to the fact that no machinery is needed for internal operation. It has no environmental impact in view of the fact that the entire facility is built underground.--

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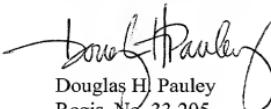
**REMARKS**

Applicants respectfully request entry of the above Preliminary Amendment to place this Patent Application in better form for examination and prosecution before the U.S. Patent and Trademark Office.

The claims have been amended to eliminate multiple dependent claims and to more definitely and fully claim the subject matter of Applicants' invention. Applicants urge that the above Preliminary Amendment introduces no new matter into this Patent Application.

Applicant sincerely believes that this Patent Application is now in condition for examination and prosecution before the U.S. Patent and Trademark Office.

Respectfully submitted,



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**MARKED-UP VERISON SHOWING CHANGES MADE**

1. (Amended) [A] In a prefabricated biological purification system for [the] treatment of residential wastewater, the system having [comprised of] two main units[. The first is] including a primary purification unit [called a Prefabricated Biological Depurator, comprised of] having modular elements of an elongated octagonal shape[, measuring 81 x 101 cm at the base and 51 cm in height. Assembled] and assembled one on top of the other, [said] wherein the modular elements form a container[,] which varies in height depending on [the] a number of [modules] the modular elements assembled [(from 3 up to a maximum of 6). The] internal elements [are comprised of] having an inflow tube, an internal separation panel with a fluid passage duct, a trapezoidal diaphragm, and a device for controlling [the] liquid outflow[. The] and the container [is made complete] with an octagonal cover[. The] , the internal modifications to the [Prefabricated Biological Depurator consist in that] primary purification unit comprising:

(a) [reduction in the height of] the internal separation panel having a first reduced height;

(b) [the placement of] a diaphragm in [the] a form of an octagonal modular element [placed] positioned approximately in [the] a middle of the container;

(c) a horizontal fluid passage duct formed as a horizontal opening of 5 cm between the separation panel and the diaphragm[, forming a horizontal fluid passage duct; and

(d) [reduction in the height of the] an intake space of [the] a flow control device having a second reduced height.

2. (Amended) [A] In the prefabricated biological purification system according to [as described in] Claim 1, wherein [characterized by all of the elements that comprise the] a secondary purification unit of the two main units comprises: [the] panels of various shapes [that once] assembled[,] to form [the] an external structure; four triangular pieces and one central octagonal piece[, which together form the] forming a bottom element; four L-shaped pieces with [3 cm] holes in [the corners] corner areas for a [the] vent tube to pass through[,] which together form [the] an intermediate structure [used to hold] holding the panels together; and a one-piece compact fluid distributor.

3. (Amended) [A] In the prefabricated biological purification system according to Claim [as described in Claims 1 and] 2, [characterized by a] wherein the one-piece compact fluid distributor, prefabricated from concrete, [requiring] requires no machinery for operation, [with] and has an intake port in [the] an upper central portion, a vent port in [the] an upper section, and fluid distribution holes in [the] a lower section.

4. (Amended) [A] In the prefabricated biological purification system [as described in] according to Claim 1, [characterized by] wherein an internal variation to the primary purifying unit [called the Prefabricated Biological Depurator, consisting of] has a horizontal fluid passageway [which can be placed] positionable at different levels inside the container, depending on [the container's] a capacity of the container [comprised] and of a diaphragm [made] constructed from an elongated octagonal element and separation panel perpendicular to [said] the elongated octagonal element, with an opening between the two elements that permits [the] internal passage of fluid from one sector to another.

5. (Amended) [A] In the prefabricated biological purification system [as described in] according to claim 1, [characterized by all of the] wherein complementary internal elements [that comprise] of the biological wastewater purification system[:] include a lower diaphragm, [a] the separation panel with [a] the fluid passage duct, [a] the flow control element, and a one-piece fluid distributor.

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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Luigi BRUSO  
Pier Enrico BRUSO

Title: PREFABRICATED BIOLOGICAL  
PURIFICATION SYSTEM

Based Upon: PCT/CR99/00001

Express Mail No.: EL859246487US

Date of Deposit: 28 November 2001

**TRANSMITTAL OF SUBSTITUTE SPECIFICATION****Box PCT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Applicants have enclosed a Substitute Specification attached to a red ink marked-up copy of the verified English language translation of PCT International Application PCT/CR99/00001. The red ink identifies changes to the verified English language translation which are incorporated in the Substitute Specification.

The Substitute Specification includes general revisions to correct idiomatic translational errors and to provide proper headings. The undersigned states that the Substitute Specification contains no new matter.

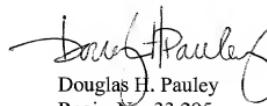
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JCB 28 NOV 2001 28 NOV 2001

Based Upon: PCT/CR99/00001

Applicants sincerely believe that this patent application is now in condition for prosecution before the U.S. Patent and Trademark Office.

Respectfully submitted,



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09/980154-022502

**"PREFABRICATED BIOLOGICAL PURIFICATION APPARATUS"**

The invention is related to a biological purification apparatus for the treatment of residential wastewater which exhibits better characteristic and performances. With respect to the prior art comprising a primary and secondary purifying unit.

5 The prefabricated biological purification apparatus is an apparatus to purify domestic sewage enclosed in the technological sector of civil construction, in the field of sewage purifying treatments.

The problem sought to be solved with this prefabricated biological purification apparatus is to purify domestic sewage in a satisfactory manner, using an easy and rapid installation 10 apparatus with a simple but efficient operating that does not need any machinery or any periodic maintenance for its internal operating.

It also intends to propose a practical and economic solution for constructors when dealing with the projection and construction of urbanizations, since the costs of the treatment plants currently used are very high, and the periodic and extraordinary maintenance costs fall on the 15 whole community, not to mention their environmental impact, for, in most cases, they are placed on the surface where anyone can see them.

EP-A-0878444 of the same applicant discloses a biological purification apparatus for the treatment of residential wastewater comprising modular elements of an elongated octagonal shape assembled one on top of the other and forming a container. It further comprises inflow 20 tube, an internal separation panel with a fluid passage duct, a trapezoidal diaphragm and a device for controlling the liquid outflow. The apparatus of EP-A-0878444 corresponds to the primary purification unit in claim 1 of the present application.

Claim 1 differs from EP-A-0878444 in the following elements:

a) reduction in the height of the internal separation panel

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5 b) the placement of a diaphragm in the form of an octagonal modular element forming a horizontal fluid passage duct with a horizontal opening between the separation panel and the diaphragm

c) reduction in the height of the intake space of the flow control device

5 d) water inlet points on both sides of the upper element

e) the presence of a secondary purifying unit comprising several concrete panels and their respective upper and lower connecting elements and a fluid liquid distributor.

The object of the invention is to obtain an improved biological purification apparatus offering high purification efficiency with respect to BOD (Biological Oxygen Demand) and SSS (Sedimentable Suspended Solids). The solution have several structural modifications as compared to the prior art:

10 i) the creation of a horizontal fluid passage duct by a reduced height of the separation panel and the introduction of the diaphragm allowing mud that passes to the second sector to come back to the first sector in the anaerobic zone and so to achieve complete decomposition

15 ii) the creation of water inlet points in the first and especially second part of the primary reactor allowing the introduction of soapy water which normally interferes with the natural fermentation process going on in the first part of the reactor

iii) a reduced entrance space in the flow control element allowing more efficient settling

iv) the presence of a secondary purifying unit used as trickling filter for further reduction of

20 the BOD and SSS values.

Neither the combination of all these features nor each of the feature taken alone can be derived from EP-A-0878444. GB-A-2276617 disclosing a modular trickling filter and resembling the second purifying unit defined in claim 1 does not disclose the primary

purification unit and there is not hint to combine the teaching EP-A-0878444 and GB-A-2276617.

A main characteristic of this apparatus is the modularization capacity of all its components, since a minimum of 25 people may be attended, without having a maximum limit.

5 It is important to point out that the minimum size for the optimal operating of the prefabricated biological purification apparatus is 25 users, as previously indicated, and the modular increase may be done in groups of 25 people, reason why the primary unit is respected, while the modular increase for the secondary unit may be done in groups of 50 people.

10 Also, with the prefabricated biological purification apparatus, the responsibility for the proper use of the sanitary facilities on the part of users from each residential unit is individualized, for a bad use of such facilities creates problems only to those who generate them, and the repair and extraordinary maintenance expenses, in this case, fall on the thoughtless user and not the whole community.

15 The invention shall be better understood from the description hereinbelow of some embodiments of the biological purification apparatus disclosed with the help of the drawing 1 to 19.

The prefabricated biological purification apparatus consists of two basic purifying units: The primary purifying unit, described in EP-A-0878444, changed external and internally, is composed of prefabricated modular elements made of concrete with an octagonal elongated shape of 81 x 101 cm. in plan and 51 cm high (Fig. 3a, 4, 5, 6) assembled one on top of the other in order to obtain an octagonal container that varies in height according to the number of assembled modules (3 to 6 modules the most). The internal elements necessary for its operating are installed inside: the inlet pipe (Fig. 7), the separation sheets with the fluid

passage duct (Fig. 8), the trapezoidal diaphragm (Fig. 10) and the flow control element modified in the entrance space (Fig. 11). The container is completed with its respective octagonal-shaped cover (Fig. 12).

The amendments to the application n. EP-A-O-0878444 consist of a reduction in the height of the internal separation sheet and the placement of a semi-concave octagonal element in the third position from the upper part (Fig. 5). Between the diaphragm of the semi-concave element and the bottom of the internal separation wall (Fig. 9), there is a space communicating between the first two sectors that allows eventual mud that passes to the second sector through the fluid passage duct (Fig. 8), to come back to the first sector in the mud digestion zone (Fig. 3b). Also, an inlet has been designed for the entrance of soapy waters on both sides of the upper octagonal element, in correspondence with the second internal sector (Fig. 6).

The secondary purifying unit is a container, in this case, with a cubic shape composed of modular L-shaped, prefabricated, 98 cm high panels made of concrete (Fig. 14a, 14b), assembled with each other and placed on four triangular pieces with proper slots to fit the panels (Fig. 17a). In the center of these triangular pieces, an octagonal bottom piece is installed (Fig. 18). The panels in the upper part are assembled with a square structure composed of other four triangular pieces, and on this structure, a liquid distributor is installed (Fig. 19a, 19b). In case it is necessary to add more panels, four intermediate triangular pieces are installed between two modules (Fig. 17b). Once all these elements are assembled, as previously explained, they compose a cubic container that varies in size according to the number of added modules. The interior of the container is filled with pebbles with a grain size distribution ranging between 2 and 4 cm Ø.

In the upper part of the secondary unit, four modular L-shaped elements, of 30 cm high, are installed on the closing elements (Fig. 15a, 15b) and it is fully completed with a square cover with its respective little lid for inspections. This last part of the container has the outlet for the general ventilation tube of 10 cm Ø and the inlet pipe to the fluid distributor 10 cm. Ø.

5 The description of the invention may be done with reference to the included drawings, which must not be interpreted as restrictive for the use thereof.

Fig. 1 - Complete apparatus (a) First purifying unit, (b) Second purifying unit.

Fig. 2 - First purifying unit, Prefabricated Biological Depurator Patent C.R. # 2540, with the respective changes, vertical section (a) Basic kind, (b) Increased type.

10 Fig. 3 - (a) Octagonal modular bottom element, 81 x 101 x 55 cm, (b) internal mud digestion zone.

Fig. 4 - Ring, octagonal modular element 81 x 101 x 51 cm.

Fig. 5 - Semi-concave octagonal modular element with a lower diaphragm (change) 81 x 101 x 5 cm.

15 Fig. 6 - Superior octagonal modular element ( 81 x 101 x 51 cm.) with supplementary inlets for soapy waters (change).

Fig. 7 - Inlet pipe

Fig. 8 - Reduced separation sheet, with the fluid passage duct (change)

Fig. 9 - Characteristics of the horizontal fluid passage duct.

20 Fig. 10 - Upper trapezoidal diaphragm.

Fig. 11 - (a) Control flug element (change), (b) Control flug in concrete (change).

Fig. 12 - Octagonal cover with little lids for inspection.

Fig. 13 - Second purifying unit, (a) Basic type, (b) Reduced type.

Fig. 14 - Modular panels, 98 cm high, (a) Normal, (b) Outlet orifice.

Fig. 15 - Modular panels, 30 cm high, (a) Normal, (b) With the outlet of 10 cm. in diameter.

Fig. 16 - Characteristics of the internal filling material.

Fig. 17 - (a) Grooved triangular pieces, (b) Intermediate triangular pieces.

Fig. 18 - Bottom octagonal piece.

5 Fig. 19 - (a) Flow distributor, (b) Vertical section.

E = in, S = out, V = ventilation

The prefabricated biological purification apparatus of domestic sewage, as previously explained, is a set of two purifying units and its operating may be explained as follows: the sewage coming from the house enters the primary unit, where the main fermentation and decomposition phase takes place, consisting of three consecutive phases of declaration and aerobic and anaerobic fermentation, with the possibility of internal re-circulation of the semi-digested mud that passes from a sector to the other, thus allowing the almost complete decomposition of the solid particles that are not detected in the effluent and do not remain in the interior of the purifying unit, for they appear in the effluent in the form of microscopic already mineralized particles.

The excellent operating efficiency occurs due to the high bacterial concentration existing in the interior of the first sector of the primary purifying unit, which allows the almost complete decomposition of the SSS (Sedimentable Suspended Solids) in approximately 99,9%, with an average effluent of  $> 0.1$  m/LH and also a high reduction degree of the DBO<sub>5</sub> (Oxygen Biochemical Demand in 5 days) in approximately 96.5%, with an average effluent of 56 mg/L. Besides, the water acidity conditions remain neutral with a constant Ph between 6.5 and 7.5. In the secondary purifying unit, the DBO<sub>5</sub> values and the remaining Total Solids in Suspension are subsequently reduced, since the liquid passing through a filling material becomes oxygenized and the bacterial film covering such material allows, by retaining the

bacteria, a subsequent phase of aerobic and partially anaerobic fermentation of the remaining polluting load. In this second purifying phase, no solids are detected and there is no mud formation.

The effluent of the prefabricated biological purification apparatus, because of its high 5 purifying degree, may be poured into any receiver container with no further treatment.

The filling material of the second unit may be of various kinds, like stone, coke, plastic segments, etc. provided that their diameter ranges between 2 and 4 cm.

The whole apparatus and the machinery need no periodic maintenance for their internal operation. Besides, the entire unit is buried; therefore, it has no environmental impact.

10 For the fermentation processes, no chemical substance or lyophilized bacterial groups are needed.

CLAIMS

1. An improved purification apparatus for the treatment of residential wastewater providing high purification efficiency and size reduction consisting of modular elements of an elongated octagonal shape assembled one on top of the other and forming a container, said 5 purification unit further comprising an inflow tube, an internal separation panel with a fluid passage duct, a trapezoidal diaphragm, and a device for controlling the liquid outflow characterized in that:

the apparatus comprises a primary and a secondary purifying unit, and includes the following 10 elements:

(a) the placement at different levels to the interior of the biological purifier of a diaphragm in 15 the form of a height reduced octagonal modular element forming thereby a horizontal fluid passage duct with a horizontal opening between the height reduced separation panel and the diaphragm, such a fluid passage allowing mud that passes to the second sector to come back to the first sector in the anaerobic zone and so to achieve complete decomposition;

(b) the creation of water inlet points in the first and especially second part of the primary reactor allowing the separate introduction of soapy water;

(c) a secondary purifying unit, filled with filling material, operating as trickling filter, and comprising several concrete panels and their respective upper and lower connecting 20 elements and a fluid liquid distributor;

(d) a reduced entrance space in the flow control element allowing more efficient settling.

2. A prefabricated biological purification apparatus according to claim 1, characterized in that the secondary purification unit comprises the panels of various shapes that, once assembled, form the external structure; four triangular pieces and one central octagonal piece, which

together form the bottom element; four L-shaped pieces with 3 cm holes in the corners for the vent tube to pass through, which together form the intermediate structure used to hold the panels together; and a one-piece compact fluid distributor.

3. A prefabricated biological purification apparatus according to claim 1, characterized in that

5 a one-piece compact fluid distributor, is prefabricated from concrete, requiring no machinery for operation, with an intake port in the upper central portion, a vent port in the upper section, and fluid distribution holes in the lower section.

4. A prefabricated biological purification apparatus according to claim 1, characterized in that

purifying unit, consist of a horizontal fluid passageway which can be placed at different levels  
10 inside the container, depending on the container's capacity, comprised of a diaphragm made from an elongated octagonal element and a separation panel perpendicular to said element, with an opening between the two elements that permits the internal passage of fluid from one sector to another.

5. A prefabricated biological purification apparatus according to claim 1, characterized in that

15 the complementary internal elements that comprise the biological wastewater purification apparatus are: a lower diaphragm, a separation panel with a fluid passage duct, a flow control element, and a one-piece fluid distributor.

## SUMMARY

The prefabricated biological purification apparatus is a complete unit to purify domestic sewage, enclosed within the technologic sector of the civil construction, specifically, in the field of sewage treatment apparatuses. It is a very versatile apparatus because it may be used

5 in different kinds of constructions, ranging from one sole residence to condominiums, buildings, complete urbanizations, etc. with unitary or multiple units, depending on the needs.

The Prefabricated Biological Purification apparatus is composed of two basic units consisting of two containers of variable dimensions, depending on the type, complete with all their modular elements, bottom, walls and cover, in addition to all the completely internal

10 elements.

All components have a shape that allows their easy handling, transportation and assembly, with no need for special machinery or qualified labor.

The operating of the apparatus may be explained as follows: the most important purifying phase takes place in the first unit, which is a Prefabricated Biological Depurator Patent C.R. #

15 2540 and EP-A-0 878 444 with internal and external changes so as to optimize its operating, in three consecutive fermentation phases: aerobic, anaerobic and declaration, with the possibility of internal re-circulation of the mud. The effluent of the purifier enters the second unit where it is evenly distributed through a fluid distributor. In this unit, the purification of the polluting matters by oxidation is completed thanks to a bacterial film that covers the filling  
20 material, since it is here where a consecutive anaerobic and partially anaerobic fermentation takes place. The effluent of the apparatus may be poured into a receptive body with no need for further treatments.

The prefabricated biological purification apparatus does not need any kind of treatments or periodic cleaning because it does not produce any mud, and since it does not need any

machinery for its internal operating, it has no usage costs, and since the whole unit is buried, it does not have any environmental impacts.

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## PREFABRICATED BIOLOGICAL PURIFICATION SYSTEM

### DESCRIPTION

5 The prefabricated biological purification system is a system to purify domestic sewage enclosed in the technological sector of civil construction, in the field of sewage purifying treatments.

10 The problem sought to be solved with this prefabricated biological purification system is to purify domestic sewage in a satisfactory manner, using an easy and rapid installation system with a simple but efficient functioning that does not need any machinery or any periodic maintenance for its internal functioning.

15 It also intends to propose a practical and economic solution for constructors when dealing with the projection and construction of urbanizations, since the costs of the treatment plants currently used are very high, and the periodic and extraordinary maintenance costs fall on the whole community, not to mention their environmental impact, for, in most cases, they are placed on the surface where anyone can see them.

20 A main characteristic of this system is the modulization capacity of all its components, since a minimum of 25 people may be attended, without having a maximum limit.

25 It is important to point out that the minimum size for the optimal functioning of the prefabricated biological purification system is 25 users, as previously indicated, and the modular increase may be done in groups of 25 people, reason why the primary unit is respected, while the modular increase for the secondary unit may be done in groups of 50 people.

30 Also, with the prefabricated biological purification system, the responsibility for the proper use of the sanitary facilities on the part of users from each residential unit is individualized, for a bad use of such facilities creates problems only to those who generate them, and the repair and extraordinary maintenance expenses, in this case, fall on the thoughtless user and not the whole community.

35 The prefabricated biological purification system consists of two basic purifying units: The primary purifying unit, the Prefabricated Biological Depurador Patent Costa Rica # 2540 and EPA-O 878 444, changed external and internally, is composed of prefabricated modular elements made of concrete with an octagonal elongated shape of 81 x 101 cm. in plan and 51 cm high (Fig. 3a, 4, 5, 6) assembled one on top of the other in order to obtain an octagonal container that varies in height according to the number of assembled modules (3 to 6 modules the most). The internal elements necessary for its functioning are installed inside: the inlet pipe (Fig. 7), the separation sheets with the fluid passage duct (Fig. 8), the trapezoidal diaphragm (Fig. 10) and the flow control element modified in the entrance space (Fig. 11). The container is completed with its respective octagonal-shaped cover (Fig. 12).

40 The amendments to the Patent C.R. # 2540 consist of a reduction in the height of the internal separation sheet and the placement of a semi-concave octagonal element in the third position from the upper part (Fig. 5). Between the diaphragm of the semi-concave element and the bottom of the internal separation wall (Fig. 9), there is a 5 cm. communicating space between the first two sectors that allows eventual mud that passes to the second sector thorough the fluid passage duct (Fig. 8), to come back to the first sector in the mud digestion zone (Fig. 3b). Also, a inlet has been designed for the entrance of soapy waters on both sides of the upper octagonal element, in correspondence with the second internal sector (Fig. 6).

45 The secondary purifying unit is a container, in this case, with a cubic shape composed of modular L-shaped, prefabricated, 98 cm high panels made of concrete (Fig. 14a, 14b), assembled with each other and placed on four triangular pieces with proper slots to fit the panels (Fig. 17a). In the center of these triangular pieces, an octagonal bottom piece is installed (Fig. 18). The panels in the upper part are

assembled with a square structure composed of other four triangular pieces, and on this structure, a liquid distributor is installed (Fig. 19a, 19b). In case it is necessary to add more panels, four intermediate triangular pieces are installed between two modules. (Fig. 17b). Once all these elements are assembled, as previously explained, they compose a cubic container that varies in size according to the number of added modules. The interior of the container is filled with pebbles with a grain size distribution ranging between 2 and 4 cm Ø.

In the upper part of the secondary unit, four modular L-shaped elements, of 30 cm. high are installed on the closing elements (Fig. 15a, 15b) and it is fully completed with a square cover with its respective little lid for inspections. This last part of the container has the outlet for the general ventilation tube of 10 cm Ø and the inlet pipe to the fluid distributor 10 cm. Ø.

The description of the invention may be done with reference to the included drawings, which must not be interpreted as restrictive for the use thereof.

15 Fig. 1 - Complete system (a) First purifying unit, (b) Second purifying unit.  
 Fig. 2 - First purifying unit, Prefabricated Biological Depurator Patent C.R. # 2540, with the respective changes, vertical section (a) Basic kind, (b) Increased type.  
 Fig. 3 - (a) Octagonal modular bottom element, 81 x 101 x 55 cm, (b) internal mud digestion zone.  
 Fig. 4 - Ring, octagonal modular element 81 x 101 x 51 cm.  
 20 Fig. 5 - Semi-concave octagonal modular element with a lower diaphragm (change) 81 x 101 x 5 cm.  
 Fig. 6 - Superior octagonal modular element ( 81 x 101 x 51 cm.) with supplementary inlets for soapy waters (change).  
 Fig. 7 - Inlet pipe  
 Fig. 8 - Reduced separation sheet, with the fluid passage duct (change)  
 25 Fig. 9 - Characteristics of the horizontal fluid passage duct.  
 Fig. 10 - Upper trapezoidal diaphragm.  
 Fig. 11 - (a) Control flug element (change), (b) Control flug in concrete (change).  
 Fig. 12 - Octagonal cover with little lids for inspection.  
 Fig. 13 - Second purifying unit, (a) Basic type, (b) Reduced type.  
 30 Fig. 14 - Modular panels, 98 cm high, (a) Normal, (b) Outlet orifice.  
 Fig. 15 - Modular panels, 30 cm high, (a) Normal, (b) With the outlet of 10 cm. in diameter.  
 Fig. 16 - Characteristics of the Internal filling material.  
 Fig. 17 - (a) Grooved triangular pieces, (b) intermediate triangular pieces.  
 Fig. 18 - Bottom octagonal piece.  
 35 Fig. 19 - (a) Flow distributor, (b) Vertical section.  
 E = in, S = out, V = ventilation

The prefabricated biological purification system of domestic sewage, as previously explained, is a set of two purifying units and its functioning may be explained as follows: the sewage coming from the house enters the primary unit, where the main fermentation and decomposition phase takes place, consisting of three consecutive phases of decantation and aerobic and anaerobic fermentation, with the possibility of internal re-circulation of the semi-digested mud that passes from a sector to the other, thus allowing the almost complete decomposition of the solid particles that are not detected in the effluent and do not remain in the interior of the purifying unit, for they appear in the effluent in the form of microscopic already mineralized particles.

The excellent functioning efficiency occurs due to the high bacterial concentration existing in the interior of the first sector of the primary purifying unit, which allows the almost complete decomposition of the SSS (Sedimentable Suspended Solids) in approximately 99,9%, with an average effluent of > 0.1 mL/H and also a high reduction degree of the  $DBO_5$  (Oxygen Biochemical Demand in 5 days) in approximately 96,5%, with an average effluent of 56 mg/L. Besides, the water acidity conditions remain neutral with a constant pH between 6.5 and 7.5. In the secondary purifying unit, the  $DBO_5$  values and the remaining Total Solids in Suspension are subsequently reduced, since the liquid passing through a filling material becomes oxygenized and the bacterial film covering such material allows, by retaining the bacteria, a subsequent phase of aerobic and partially anaerobic fermentation of the remaining polluting load. In this second purifying phase, no solids are detected and there is no mud formation.

5 The effluent of the prefabricated biological purification system, because of its high purifying degree, may be poured into any receiver container with no further treatment.

10 The filling material of the second unit may be of various kinds, like stone, coke, plastic segments, etc. provided that their diameter ranges between 2 and 4 cm.

15 The whole system and the machinery need no periodic maintenance for their internal operation. Besides, the entire unit is buried; therefore, it has no environmental impact.

20 For the fermentation processes, no chemical substance or lyophilized bacterial groups are needed.

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## CLAIMS

5 1. A prefabricated biological purification system for the treatment of residential wastewater, comprised of two main units. The first is a primary purification unit called a Prefabricated Biological Depurator, comprised of modular elements of an elongated octagonal shape, measuring 81 x 101 cm. at the base and 51 cm. in height. Assembled one on top of the other, said modular elements form a container, which varies in height depending on the number of modules assembled (from 3 up to a maximum of 6). The internal elements are comprised of an inflow tube, an internal separation panel with a fluid passage duct, a trapezoidal diaphragm, and a device for controlling the liquid outflow. The container is made complete with an octagonal cover.

10 The internal modifications to the Prefabricated Biological Depurator consist in that:

(a) reduction in the height of the internal separation panel;  
(b) the placement of a diaphragm in the form of an octagonal modular element placed approximately in the middle of the container;  
15 (c) horizontal opening of 5 cm. between the separation panel and the diaphragm, forming a horizontal fluid passage duct;  
(d) reduction in the height of the intake space of the flow control device.

20 The external modification to the Prefabricated Biological Depurator consists of the placement of the soapy water inlet points on both sides of the upper element corresponding to the purifier's second internal sector.

25 The system is completed with a secondary purifying unit comprised of several prefabricated concrete panels and their respective upper and lower connecting elements, along with a fluid distributor. All of the system components are modular, and thus the respective dimensions and capacities of the containers vary depending on the number of modules used.

30 2. A prefabricated biological purification system as described in Claim 1, characterized by all of the elements that comprise the secondary purification unit: the panels of various shapes that, once assembled, form the external structure; four triangular pieces and one central octagonal piece, which together form the bottom element; four L-shaped pieces with 3 cm. holes in the corners for the vent tube to pass through, which together form the intermediate structure used to hold the panels together; and a one-piece compact fluid distributor.

35 3. A prefabricated biological purification system as described in Claims 1 and 2, characterized by a one-piece compact fluid distributor, prefabricated from concrete, requiring no machinery for operation, with an intake port in the upper central portion, a vent port in the upper section, and fluid distribution holes in the lower section.

40 4. A prefabricated biological purification system as described in Claim 1, characterized by an internal variation to the primary purifying unit called the Prefabricated Biological Depurator, consisting of a horizontal fluid passageway which can be placed at different levels inside the container, depending on the container's capacity, comprised of a diaphragm made from an elongated octagonal element and a separation panel perpendicular to said element, with an opening between the two elements that permits the internal passage of fluid from one sector to another.

45 5. A prefabricated biological purification system as described in claim 1, characterized by all of the complementary internal elements that comprise the biological wastewater purification system: a lower diaphragm, a separation panel with a fluid passage duct, a flow control element, and a one-piece fluid distributor.

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**PREFABRICATED BIOLOGICAL PURIFICATION SYSTEM**

09/980154-022502

## BACKGROUND OF THE INVENTION

The prefabricated biological purification system is used to purify domestic sewage enclosed in the technological sector of civil construction, in the field of sewage purifying treatments.

One problem to be solved with this prefabricated biological purification system is to purify domestic sewage in a satisfactory manner, using an easy and rapid installation system with simple but efficient functioning that requires no machinery or periodic maintenance for its internal functioning.

The system also provides a practical and economic solution for constructors when dealing with the projection and construction of urbanizations, because the costs of the treatment plants currently used are very high, and the periodic and extraordinary maintenance costs fall on the entire community, not to mention their environmental impact, because they are placed on the surface where anyone can see them.

One main characteristic of this system is the modulization capacity of all its components, because a minimum of 25 people may be attended, without having a maximum limit.

It is important to note that the minimum size for the optimal functioning of the prefabricated biological purification system is 25 users, as previously indicated. A modular increase may be done in groups of 25 people, a reason why the primary

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unit is respected, while the modular increase for the secondary unit may be done in groups of 50 people.

Also, with the prefabricated biological purification system, responsibility for the proper use of the sanitary facilities by the users from each residential unit is individualized, for improper use of such facilities creates problems only to those who generate them. Repair and extraordinary maintenance expenses, in this case, fall on the thoughtless user and not the entire community.

#### **SUMMARY OF THE INVENTION**

The prefabricated biological purification apparatus of this invention is a complete unit to purify domestic sewage, enclosed within the technologic sector of the civil construction, specifically, in the field of sewage treatment apparatuses. It is a very versatile apparatus because it may be used in different kinds of constructions, ranging from a single residence to condominiums, buildings, complete urbanizations, etc. with unitary or multiple units, depending on the needs. The Prefabricated Biological Purification apparatus of this invention has two basic units with two containers of variable dimensions, depending on the type, complete with all their modular elements, bottom, walls and cover, in addition to all the completely internal elements.

All components have a shape that allows easy handling, transportation and assembly, with no installation need for special machinery or qualified labor.

Operation of the apparatus may be explained as follows: one important purifying phase occurs in the first unit, which is a Prefabricated Biological Depurator according to Patent Costa Rica No. 2540 and European Patent Reference EP-A-0 878 444 with internal and external changes so as to optimize operation, in three consecutive fermentation phases: aerobic, anaerobic and declaration, with the possibility of internal re-circulation of mud. The effluent of the purifier enters the second unit where it is evenly distributed through a fluid distributor. In the second unit, the purification of the polluting matters by oxidation is accomplished with a bacterial film that covers the filling material, where a consecutive anaerobic and partially anaerobic fermentation occurs. The effluent of the apparatus may be poured into a receptive body with no need for further treatments.

The prefabricated biological purification apparatus needs no kind of treatments or periodic cleaning because it produces no mud, and because it needs no machinery for its internal operating, it has no usage costs, and because the entire unit is buried, it does not have environmental impacts.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

This invention is described with reference to the included drawings, wherein:

Fig. 1a is a partial cut-away view of a first purifying unit of a complete system;

Fig. 1b is a partial cut-away view of a second purifying unit of a complete system;

Fig. 2a is a vertical sectional view of a first purifying unit, according to Patent Costa Rica No. 2540, of a basic type;

Fig. 2b is a vertical sectional view of a first purifying unit, according to Patent Costa Rica No. 2540, of an increased type;

Fig. 3a is a partial cut-away perspective view of an octagonal modular bottom element, 81 x 101 x 55 cm;

Fig. 3b is a schematic view of an internal mud digestion zone;

Fig. 4 is a perspective view of a ring, an octagonal modular element 81 x 101 x 51 cm;

Fig. 5 is a perspective view of a semi-concave octagonal modular element with a lower diaphragm (change) 81 x 101 x 5 cm;

Fig. 6 is perspective view of an octagonal modular element (81 x 101 x 51 cm) with supplemental inlets for soapy waters (change);

Fig. 7 is a view of an inlet pipe;

Fig. 8 is a view of a reduced separation sheet, with a fluid passage duct (change);

Fig. 9 is a view of characteristics of a horizontal fluid passage duct;

Fig. 10 is a view of an upper trapezoidal diaphragm;

Fig. 11a is a view of a control flug element (change);

Fig. 11b is a view of a control flug in concrete (change);

Fig. 12 is a view of an octagonal cover with small inspection lids;

Fig. 13a is a view of a second purifying unit, a basic type;

Fig. 13b is a view of a second purifying unit, a reduced type;

Fig. 14a is a view of a normal modular panel, 98 centimeters high;

Fig. 14b is a view of a outlet orifice of modular panels, 98 centimeters high;

Fig. 15a is a view of a normal modular panel, 30 centimeters high;

Fig. 15b is a view of modular panels, 30 centimeters high, having an outlet of 10 centimeters in diameter;

Fig. 16 shows characteristics of internal filling material;

Fig. 17a shows a view of a grooved triangular piece;

Fig. 17b shows a view of an intermediate triangular piece;

Fig. 18 shows a bottom octagonal piece;

Fig. 19a shows a flow distributor; and

Fig. 19b shows a vertical section.

In the drawings, E= in, S= out, and V= ventilation.

#### **DESCRIPTION OF PREFERRED EMBODIMENTS**

The prefabricated biological purification system comprises two basic purifying units: a primary purifying unit, such as the Prefabricated Biological Depurator disclosed in Patent Costa Rica No. 2540 and European Patent Reference

EP-A-0 878 444, changed external and internally, having prefabricated modular elements made of concrete with an octagonal elongated shape of 81 x 101 cm. In plant and 51 cm high (Figs. 3a, 4, 5, 6) assembled one on top of the other in order to obtain an octagonal container that varies in height according to the number of assembled modules (3 to 6 modules maximum). The internal elements necessary for functioning are installed inside: the inlet pipe (Fig. 7), the separation sheets with the fluid passage duct (Fig. 8), the trapezoidal diaphragm (Fig. 10), and the flow control element modified in the entrance space (Fig. 11). The container is completed with its respective octagonal-shaped cover (Fig. 12).

The amendments to the Patent Costa Rica No. 2540 include a reduction in the height of the internal separation sheet and the placement of a semi-concave octagonal element in the third position from the upper part (Fig. 5). Between the diaphragm of the semi-concave element and the bottom of the internal separation wall (Fig. 9), there is a 5 cm communicating space between the first two sectors that allows eventual mud that passes to the second sector through the fluid passage duct (Fig. 8), to return to the first sector in the mud digestion zone (Fig. 3b). Also, an inlet is designed for the entrance of soapy waters on both sides of the upper octagonal element, in correspondence with the second internal sector (Fig. 6).

The secondary purifying unit is a container, in this case, with a cubic shape having modular L-shaped, prefabricated, 98 cm high panels made of concrete (Figs. 14a, 14b), assembled with each other and placed on four triangular pieces with

proper slots to fit the panels (Fig. 17a). In the center of these triangular pieces, an octagonal bottom piece is installed (Fig. 18). The panels in the upper part are assembled with a square structure composed of four triangular pieces, and on this structure, a liquid distributor is installed (Figs. 19a, 19b). If it is necessary to add more panels, four intermediate triangular pieces are installed between two modules (Fig. 17b). Once all these elements are assembled, as previously explained, they compose a cubic container that varies in size according to the number of added modules. The interior of the container is filled with pebbles with a grain size distribution ranging between 2 and 4 cm diameter.

In the upper part of the secondary unit, four modular L-shaped elements, of 30 cm high are installed on the closing elements (Figs. 15a, 15b) and it is fully completed with a square cover with a small lid for inspections. This last part of the container has the outlet for the general ventilation tube of 10 cm diameter and the inlet pipe to the fluid distributor 10 cm diameter.

The prefabricated biological purification system of domestic sewage, as previously explained, includes a set of two purifying units and its functioning is further explained in the following specification. The sewage coming from the house enters the primary unit, where a main fermentation and decomposition phase takes place, including three consecutive phases of decantation and aerobic and anaerobic fermentation, with the possibility of internal re-circulation of the semi-digested mud that passes from a sector to the other, thus allowing the almost complete

decomposition of the solid particles that are not detected in the effluent and that do not remain in the interior of the purifying unit, because they appear in the effluent in the form of microscopic already mineralized particles.

The excellent functioning efficiency occurs due to the high bacterial concentration existing in the interior of the first sector of the primary purifying unit, which allows the almost complete decomposition of the SSS (Sedimentable Suspended Solids) in approximately 99.9%, with an average effluent of greater than 0.1 m/LH and also a high reduction degree of the  $DBO_5$  (Oxygen Biochemical Demand in 5 days) in approximately 96.5%, with an average effluent of 56 mg/L. Besides, the water acidity conditions remain neutral with a constant Ph between 6.5 and 7.5. In the secondary purifying unit, the  $DBO_5$  values and the remaining Total Solids in Suspension are subsequently reduced, since the liquid passing through a filling material becomes oxygenized and the bacterial film covering such material allows, by retaining the bacteria, a subsequent phase of aerobic and partially anaerobic fermentation of the remaining polluting load. In this second purifying phase, no solids are detected and there is no mud formation.

The effluent of the prefabricated biological purification system, because of its high purifying degree, may be poured into any receiver container with no further treatment.

The filling material of the second unit may be of various kinds, such as stone, coke, plastic segments, and the like provided that their diameter ranges between 2 and 4 cm.

The entire system and the machinery need no periodic maintenance for internal operation. Besides, the entire unit is buried and thus has no environmental impact. For the fermentation processes, no chemical substance or lyophilized bacterial groups are needed.

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# PREFABRICATED BIOLOGICAL PURIFICATION SYSTEM

## [DESCRIPTION]

## BACKGROUND OF THE INVENTION

5 The prefabricated biological purification system is a system to purify domestic sewage enclosed in the technological sector of civil construction, in the field of sewage purifying treatments.

One The problem to be solved with this prefabricated biological purification system is to purify domestic sewage in a satisfactory manner, using an easy and rapid installation system with simple but efficient functioning that does not need any machinery or any periodic maintenance for its internal functioning.

10 The system also provides a practical and economic solution for constructors when dealing with the projection and construction of urbanizations, because the costs of the treatment plants currently used are very high, and the periodic and extraordinary maintenance costs fall on the whole community, not to mention their environmental impact, for, in most cases, they are placed on the surface where anyone can see them.

15 A main characteristic of this system is the modulization capacity of all its components, because a minimum of 25 people may be attended, without having a maximum limit.

It is important to point out that the minimum size for the optimal functioning of the prefabricated biological purification system is 25 users, as previously indicated, and the modular increase may be done in groups of 25 people, reason why the primary unit is respected, while the modular increase for the secondary unit may be done in groups of 50 people.

20 Also, with the prefabricated biological purification system, the responsibility for the proper use of the sanitary facilities by the users from each residential unit is individualized, for the use of such facilities creates problems only to those who generate them, and the repair and extraordinary maintenance expenses, in this case, fall on the thoughtless user and not the whole community.

25 The prefabricated biological purification system consists of two basic purifying units. The primary purifying unit, such as the Prefabricated Biological Depuradora Patent Costa Rica # 2540 and European Patent Reference EP-A-0 878 444, changed external and internally, is composed of prefabricated modular elements made of concrete with an octagonal elongated shape of 81 x 101 cm. in plant and 51 cm high (Fig. 3a, 4, 5, 6) assembled one

30 on top of the other in order to obtain an octagonal container that varies in height according to the number of assembled modules (3 to 6 modules the most). The internal elements necessary for its functioning are installed inside: the inlet pipe (Fig. 7), the separation sheets with the fluid passage duct (Fig. 8), the trapezoidal diaphragm (Fig. 10), and the flow control element modified in the entrance space (Fig. 11). The container is completed with its respective octagonal-shaped cover (Fig. 12).

35 The amendments to the Patent C.R. # 2540 consist of a reduction in the height of the internal separation sheet and the placement of a semi-concave octagonal element in the third position from the upper part (Fig. 5). Between the diaphragm of the semi-concave element and the bottom of the internal separation wall (Fig. 9), there is a 5 cm. communicating space between the first two sectors that allows eventual mud that passes to the second sector (through the fluid passage duct (Fig. 8), to come back return to the first sector in the mud digestion zone (Fig. 3b). Also, a slot has been designed for the entrance of soapy waters on both sides of the upper octagonal element, in correspondence with the second internal sector (Fig. 6).

40 The secondary purifying unit is a container, in this case, with a cubic shape composed of modular L-shaped, prefabricated, 98 cm high panels made of concrete (Fig. 14a, 14b), assembled with each other and placed on four triangular pieces with proper slots to fit the panels (Fig. 17a). In the center of these triangular pieces, an octagonal bottom piece is installed (Fig. 18). The panels in the upper part are

### SUMMARY OF THE INVENTION

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### BRIEF DESCRIPTION OF THE DRAWINGS

AMENDED SHEET

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for description of Fig.

assembled with a square structure composed of [other] four triangular pieces, and on this structure, a liquid distributor is installed (Fig. 19a, 19b). [In case] it is necessary to add more panels, four intermediate triangular pieces are installed between two modules. [Fig. 17b]. Once all these elements are assembled, as previously explained, they compose a cubic container that varies in size according to the number of added modules. The interior of the container is filled with pebbles with a grain size distribution ranging between 2 and 4 cm of diameter

5 In the upper part of the secondary unit, four modular L-shaped elements, of 30 cm. high are installed on the closing elements (Fig. 15a, 15b) and it is fully completed with a square cover with [its] respective small lid for inspections. This last part of the container has the outlet for the general ventilation tube of 10 cm [of] diameter and the inlet pipe to the fluid distributor 10 cm [of] diameter

10 This [is described] [The description of the invention [may be done] with reference to the included drawings, which must not be interpreted as restrictive for the use thereof.] wherein :

15 Fig. 1 - Complete system (a) First purifying unit, (b) Second purifying unit.

Fig. 2 - First purifying unit, Prefabricated Biological Depurator Patent C.R. # 2540, with the respective changes, vertical section (a) Basic kind, (b) Increased type.

Fig. 3 - (a) Octagonal modular bottom element, 81 x 101 x 55 cm, (b) internal mud digestion zone.

Fig. 4 - Ring, octagonal modular element 81 x 101 x 51 cm.

20 Fig. 5 - Semi-concave octagonal modular element with a lower diaphragm (change) 81 x 101 x 5 cm.

Fig. 6 - Superior octagonal modular element ( 81 x 101 x 51 cm.) with supplementary inlets for soapy waters (change).

Fig. 7 - Inlet pipe

Fig. 8 - Reduced separation sheet, with the fluid passage duct (change)

25 Fig. 9 - Characteristics of the horizontal fluid passage duct.

Fig. 10 - Upper trapezoidal diaphragm.

Fig. 11 - (a) Control flug element (change), (b) Control flug in concrete (change).

Fig. 12 - Octagonal cover with little lids for inspection.

Fig. 13 - Second purifying unit, (a) Basic type, (b) Reduced type.

30 Fig. 14 - Modular panels, 98 cm high, (a) Normal, (b) Outlet orifices.

Fig. 15 - Modular panels, 30 cm high, (a) Normal, (b) With the outlet of 10 cm. in diameter.

Fig. 16 - Characteristics of the internal filling material.

Fig. 17 - (a) Grooved triangular pieces, (b) Intermediate triangular pieces.

Fig. 18 - Bottom octagonal piece.

35 Fig. 19 - (a) Flow distributor, (b) Vertical section.

E = In, S = out, V = ventilation.

In the drawings,

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Specification

includes

The prefabricated biological purification system of domestic sewage, as previously explained, [is] a set of two purifying units and its functioning [may be] explained [as follows]: the sewage coming from the house enters the primary unit, where [the] main fermentation and decomposition phase takes place, [consisting of] three consecutive phases of decantation and aerobic and anaerobic fermentation, with the possibility of internal re-circulation of the semi-digested mud that passes from a sector to the other, thus allowing the almost complete decomposition of the solid particles that are not detected in the effluent and [do not remain in the interior of the purifying unit, for] they appear in the effluent in the form of microscopic already mineralized particles.

because

The excellent functioning efficiency occurs due to the high bacterial concentration existing in the interior of the first sector of the primary purifying unit, which allows the almost complete decomposition of the SSS (Sedimentable Suspended Solids) in approximately [99,9%], with an average effluent of [x] greater than 0.1 mL/H and also a high reduction degree of the  $DBO_5$  (Oxygen Biochemical Demand in 5 days) in approximately 96.5%, with an average effluent of 56 mg/L. Besides, the water acidity conditions remain neutral with a constant Ph between 6.5 and 7.5. In the secondary purifying unit, the  $DBO_5$  values and the remaining Total Solids in Suspension are subsequently reduced, since the liquid passing through a filling material becomes oxygenized and the bacterial film covering such material allows, by retaining the bacteria, a subsequent phase of aerobic and partially anaerobic fermentation of the remaining polluting load. In this second purifying phase, no solids are detected and there is no mud formation.

The effluent of the prefabricated biological purification system, because of its high purifying degree, may be poured into any receiver contained with no further treatment, such as

and the like[etc] provided that their diameter ranges between 2 and 4 cm.

15 The [whole] <sup>entire</sup> system and the machinery need no periodic maintenance for [their] internal operation. Besides, the entire unit is buried, therefore, it has no environmental impact.

For the fermentation processes, no chemical substance or lyophilized bacterial groups are needed.

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[SUMMARY]

The prefabricated biological purification apparatus is a complete unit to purify domestic sewage, enclosed within the technologic sector of the civil construction, specifically, in the field of sewage treatment apparatuses. It is a very versatile apparatus because it may be used 5 in different kinds of constructions, ranging from [one sole] <sup>a single</sup> residence to condominiums, buildings, complete urbanizations, etc. with unitary or multiple units, depending on the needs.

The Prefabricated Biological Purification apparatus is composed of two basic units [consisting with of] two containers of variable dimensions, depending on the type, complete with all their modular elements, bottom, walls and cover, in addition to all the completely internal 10 elements.

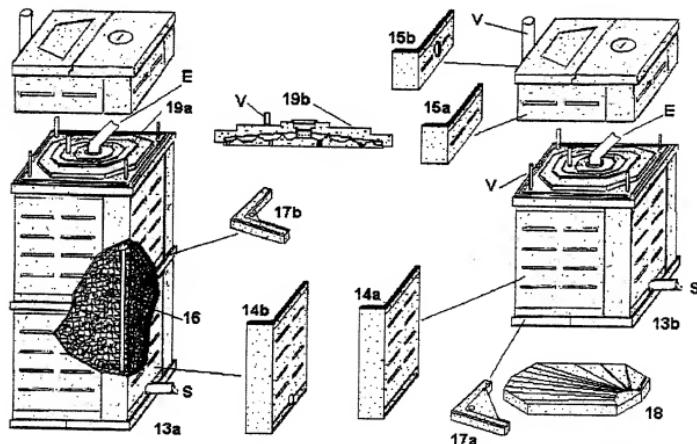
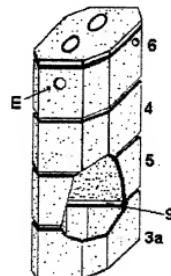
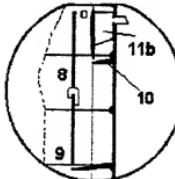
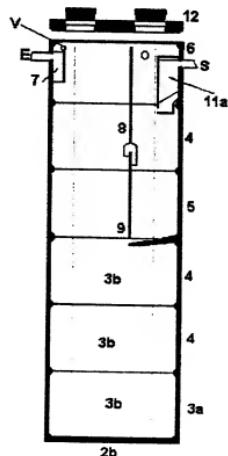
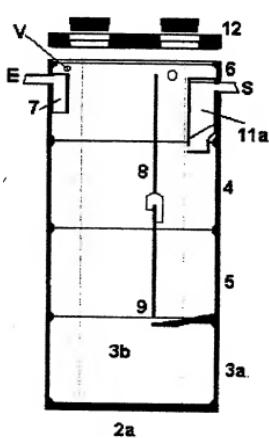
All components have a shape that allows [their] easy handling, transportation and assembly, with no need for special machinery or qualified labor.

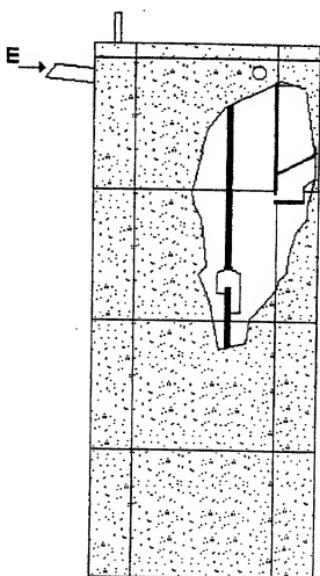
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[The operating] of the apparatus may be explained as follows: [the most] <sup>one</sup> important purifying phase [takes place] in the first unit, which is a Prefabricated Biological Depurator <sup>according to</sup> [Costa Rica No. European Patent Reference 15 2540 and EP-A-0 878 444 with internal and external changes so as to optimize] [its operating, in operation three consecutive fermentation phases: aerobic, anaerobic and declaration, with the possibility of internal re-circulation of [the] mud. The effluent of the purifier enters the second unit where it is evenly distributed through a fluid distributor. In [this] <sup>the second</sup> unit, the purification of the polluting matters by oxidation is [completed thanks to] a bacterial film that covers the filling 20 material, [since it is here] where a consecutive anaerobic and partially anaerobic fermentation occurs [takes place]. The effluent of the apparatus may be poured into a receptive body with no need for further treatments.

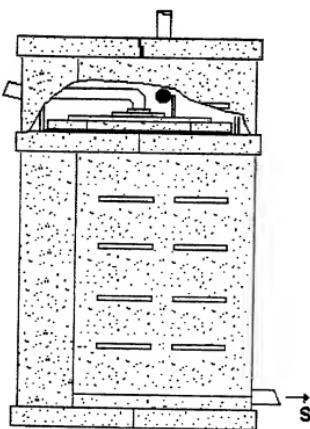
The prefabricated biological purification apparatus [does not need any] kind of treatments or periodic cleaning because it [does not produce any] mud, and [since] it [does not need any] produces no needs no

machinery for its internal operating, it has no usage costs, and [since] the [whole] unit is buried, it does not have [any] environmental impacts. *because* *entire*





1a



1b

**"PREFABRICATED BIOLOGICAL PURIFICATION APPARATUS"**

The invention is related to a biological purification apparatus for the treatment of residential wastewater which exhibits better characteristic and performances. With respect to the prior art comprising a primary and secondary purifying unit.

5 The prefabricated biological purification apparatus is an apparatus to purify domestic sewage enclosed in the technological sector of civil construction, in the field of sewage purifying treatments.

The problem sought to be solved with this prefabricated biological purification apparatus is to purify domestic sewage in a satisfactory manner, using an easy and rapid installation 10 apparatus with a simple but efficient operating that does not need any machinery or any periodic maintenance for its internal operating.

It also intends to propose a practical and economic solution for constructors when dealing with the projection and construction of urbanizations, since the costs of the treatment plants currently used are very high, and the periodic and extraordinary maintenance costs fall on the 15 whole community, not to mention their environmental impact, for, in most cases, they are placed on the surface where anyone can see them.

EP-A-0878444 of the same applicant discloses a biological purification apparatus for the treatment of residential wastewater comprising modular elements of an elongated octagonal shape assembled one on top of the other and forming a container. It further comprises inflow 20 tube, an internal separation panel with a fluid passage duct, a trapezoidal diaphragm and a device for controlling the liquid outflow. The apparatus of EP-A-0878444 corresponds to the primary purification unit in claim 1 of the present application.

Claim 1 differs from EP-A-0878444 in the following elements:

a) reduction in the height of the internal separation panel

← b) the placement of a diaphragm in the form of an octagonal modular element forming a horizontal fluid passage duct with a horizontal opening between the separation panel and the diaphragm

5 c) reduction in the height of the intake space of the flow control device

d) water inlet points on both sides of the upper element

e) the presence of a secondary purifying unit comprising several concrete panels and their respective upper and lower connecting elements and a fluid/liquid distributor.

The object of the invention is to obtain an improved biological purification apparatus offering high purification efficiency with respect to BOD (Biological Oxygen Demand) and SSS (Sedimentable Suspended Solids). The solution have several structural modifications as compared to the prior art:

10 i) the creation of a horizontal fluid passage duct by a reduced height of the separation panel and the introduction of the diaphragm allowing mud that passes to the second sector to come back to the first sector in the anaerobic zone and so to achieve complete decomposition

15 ii) the creation of water inlet points in the first and especially second part of the primary reactor allowing the introduction of soapy water which normally interferes with the natural fermentation process going on in the first part of the reactor

iii) a reduced entrance space in the flow control element allowing more efficient settling

iv) the presence of a secondary purifying unit used as trickling filter for further reduction of 20 the BOD and SSS values.

Neither the combination of all these features nor each of the feature taken alone can be derived from EP-A-0878444. GB-A-2276617 disclosing a modular trickling filter and resembling the second purifying unit defined in claim 1 does not disclose the primary

purification unit and there is not hint to combine the teaching EP-A-0878444 and GB-A-2276617.

A main characteristic of this apparatus is the modularization capacity of all its components, since a minimum of 25 people may be attended, without having a maximum limit.

5 It is important to point out that the minimum size for the optimal operating of the prefabricated biological purification apparatus is 25 users, as previously indicated, and the modular increase may be done in groups of 25 people, reason why the primary unit is respected, while the modular increase for the secondary unit may be done in groups of 50 people.

10 Also, with the prefabricated biological purification apparatus, the responsibility for the proper use of the sanitary facilities on the part of users from each residential unit is individualized, for a bad use of such facilities creates problems only to those who generate them, and the repair and extraordinary maintenance expenses, in this case, fall on the thoughtless user and not the whole community.

15 The invention shall be better understood from the description hereinbelow of some embodiments of the biological purification apparatus disclosed with the help of the drawing 1 to 19.

The prefabricated biological purification apparatus consists of two basic purifying units: The primary purifying unit, described in EP-A-0878444, changed external and internally, is composed of prefabricated modular elements made of concrete with an octagonal elongated shape of 81 x 101 cm. in plant and 51 cm high (Fig. 3a, 4, 5, 6) assembled one on top of the other in order to obtain an octagonal container that varies in height according to the number of assembled modules (3 to 6 modules the most). The internal elements necessary for its operating are installed inside: the inlet pipe (Fig. 7), the separation sheets with the fluid

passage duct (Fig. 8), the trapezoidal diaphragm (Fig. 10) and the flow control element modified in the entrance space (Fig. 11). The container is completed with its respective octagonal-shaped cover (Fig. 12).

The amendments to the application n. EP-A-O-0878444 consist of a reduction in the height of 5 the internal separation sheet and the placement of a semi-concave octagonal element in the third position from the upper part (Fig. 5). Between the diaphragm of the semi-concave element and the bottom of the internal separation wall (Fig. 9), there is a space communicating between the first two sectors that allows eventual mud that passes to the second sector through the fluid passage duct (Fig. 8), to come back to the first sector in the 10 mud digestion zone (Fig. 3b). Also, an inlet has been designed for the entrance of soapy waters on both sides of the upper octagonal element, in correspondence with the second internal sector (Fig. 6).

The secondary purifying unit is a container, in this case, with a cubic shape composed of 15 modular L-shaped, prefabricated, 98 cm high panels made of concrete (Fig. 14a, 14b), assembled with each other and placed on four triangular pieces with proper slots to fit the panels (Fig. 17a). In the center of these triangular pieces, an octagonal bottom piece is installed (Fig. 18). The panels in the upper part are assembled with a square structure composed of other four triangular pieces, and on this structure, a liquid distributor is installed (Fig. 19a, 19b). In case it is necessary to add more panels, four intermediate triangular pieces 20 are installed between two modules (Fig. 17b). Once all these elements are assembled, as previously explained, they compose a cubic container that varies in size according to the number of added modules. The interior of the container is filled with pebbles with a grain size distribution ranging between 2 and 4 cm. 0

—In the upper part of the secondary unit, four modular L-shaped elements, of 30 cm high, are installed on the closing elements (Fig. 15a, 15b) and it is fully completed with a square cover with its respective little lid for inspections. This last part of the container has the outlet for the general ventilation tube of 10 cm Ø and the inlet pipe to the fluid distributor 10 cm. Ø.

5 The description of the invention may be done with reference to the included drawings, which must not be interpreted as restrictive for the use thereof.

Fig. 1 - Complete apparatus (a) First purifying unit, (b) Second purifying unit.

Fig. 2 - First purifying unit, Prefabricated Biological Depurator Patent C.R. # 2540, with the respective changes, vertical section (a) Basic kind, (b) Increased type.

10 Fig. 3 - (a) Octagonal modular bottom element, 81 x 101 x 55 cm, (b) internal mud digestion zone.

Fig. 4 - Ring, octagonal modular element 81 x 101 x 51 cm.

Fig. 5 - Semi-concave octagonal modular element with a lower diaphragm (change) 81 x 101 x 5 cm.

15 Fig. 6 - Superior octagonal modular element ( 81 x 101 x 51 cm.) with supplementary inlets for soapy waters (change).

Fig. 7 - Inlet pipe

Fig. 8 - Reduced separation sheet, with the fluid passage duct (change)

Fig. 9 - Characteristics of the horizontal fluid passage duct.

20 Fig. 10 - Upper trapezoidal diaphragm.

Fig. 11 - (a) Control flug element (change), (b) Control flug in concrete (change)

Fig. 12 - Octagonal cover with little lids for inspection.

Fig. 13 - Second purifying unit, (a) Basic type, (b) Reduced type.

Fig. 14 - Modular panels, 98 cm high, (a) Normal, (b) Outlet orifice.

Fig. 15 - Modular panels, 30 cm high, (a) Normal, (b) With the outlet of 10-cm. in diameter

Fig. 16 - Characteristics of the internal filling material.

Fig. 17 - (a) Grooved triangular pieces, (b) Intermediate triangular pieces.

Fig. 18 - Bottom octagonal piece.

5 Fig. 19 - (a) Flow distributor, (b) Vertical section.

E = in, S = out, V = ventilation

The prefabricated biological purification apparatus of domestic sewage, as previously explained, is a set of two purifying units and its operating may be explained as follows: the sewage coming from the house enters the primary unit, where the main fermentation and decomposition phase takes place, consisting of three consecutive phases of declaration and

10 aerobic and anaerobic fermentation, with the possibility of internal re-circulation of the semi-digested mud that passes from a sector to the other, thus allowing the almost complete decomposition of the solid particles that are not detected in the effluent and do not remain in the interior of the purifying unit, for they appear in the effluent in the form of microscopic 15 already mineralized particles.

The excellent operating efficiency occurs due to the high bacterial concentration existing in the interior of the first sector of the primary purifying unit, which allows the almost complete decomposition of the SSS (Sedimentable Suspended Solids) in approximately 99,9%, with an average effluent of  $> 0.1$  m/LH and also a high reduction degree of the DBO<sub>5</sub> (Oxygen

20 Biochemical Demand in 5 days) in approximately 96.5%, with an average effluent of 56 mg/L. Besides, the water acidity conditions remain neutral with a constant Ph between 6.5 and 7.5. In the secondary purifying unit, the DBO<sub>5</sub> values and the remaining Total Solids in Suspension are subsequently reduced, since the liquid passing through a filling material becomes oxygenized and the bacterial film covering such material allows, by retaining the

—bacteria, a subsequent phase of aerobic and partially anaerobic fermentation of the remaining polluting load. In this second purifying phase, no solids are detected and there is no mud formation.

5 The effluent of the prefabricated biological purification apparatus, because of its high purifying degree, may be poured into any receiver container with no further treatment.

The filling material of the second unit may be of various kinds, like stone, coke, plastic segments, etc. provided that their diameter ranges between 2 and 4 cm.

The whole apparatus and the machinery need no periodic maintenance for their internal operation. Besides, the entire unit is buried; therefore, it has no environmental impact.

10 For the fermentation processes, no chemical substance or lyophilized bacterial groups are needed.

- CLAIMS

1. An improved purification apparatus for the treatment of residential wastewater providing high purification efficiency and size reduction consisting of modular elements of an elongated octagonal shape assembled one on top of the other and forming a container, said purification unit further comprising an inflow tube, an internal separation panel with a fluid passage duct, a trapezoidal diaphragm, and a device for controlling the liquid outflow characterized in that:

the apparatus comprises a primary and a secondary purifying unit, and includes the following elements:

10 (a) the placement at different levels to the interior of the biological purifier of a diaphragm in the form of a height reduced octagonal modular element forming thereby a horizontal fluid passage duct with a horizontal opening between the height reduced separation panel and the diaphragm, such a fluid passage allowing mud that passes to the second sector to come back to the first sector in the anaerobic zone and so to achieve complete decomposition;

15 (b) the creation of water inlet points in the first and especially second part of the primary reactor allowing the separate introduction of soapy water;

(c) a secondary purifying unit, filled with filling material, operating as trickling filter, and comprising several concrete panels and their respective upper and lower connecting elements and a fluid liquid distributor;

20 (d) a reduced entrance space in the flow control element allowing more efficient settling.

2. A prefabricated biological purification apparatus according to claim 1, characterized in that the secondary purification unit comprises the panels of various shapes that, once assembled, form the external structure; four triangular pieces and one central octagonal piece, which-

together form the bottom element, four L-shaped pieces with 3-cm holes in the corners for the vent tube to pass through, which together form the intermediate structure used to hold the panels together, and a one-piece compact fluid distributor.

3. A prefabricated biological purification apparatus according to claim 1, characterized in that

5 a one-piece compact fluid distributor, is prefabricated from concrete, requiring no machinery for operation, with an intake port in the upper central portion, a vent port in the upper section, and fluid distribution holes in the lower section.

4. A prefabricated biological purification apparatus according to claim 1, characterized in that

10 purifying unit, consist of a horizontal fluid passageway which can be placed at different levels inside the container, depending on the container's capacity, comprised of a diaphragm made from an elongated octagonal element and a separation panel perpendicular to said element, with an opening between the two elements that permits the internal passage of fluid from one sector to another.

5. A prefabricated biological purification apparatus according to claim 1, characterized in that

15 the complementary internal elements that comprise the biological wastewater purification apparatus are: a lower diaphragm, a separation panel with a fluid passage duct, a flow control element, and a one-piece fluid distributor.

## Declaration and Power of Attorney for Patent Application

### Declaración y poder para solicitud de patente

#### Spanish Language Declaration

Como inventor abajo nombrado, por este medio declaro que:

Mi residencia, dirección postal y ciudadanía son los que indican a continuación, al lado de mi nombre.

Considero que soy el primer, original y único inventor (si hay un solo nombre indicado a continuación) o el primer, original y único inventor conjunto (en caso de múltiples nombres a continuación) de la materia objeto de la reivindicación y para la cual se solicita una patente sobre el invento titulado

#### SISTEMA PREFABRICADO DE

#### DEPURACION BIOLOGICA

cuya descripción se anexa a la presente, salvo que se marque la siguiente casilla:

fue presentada el \_\_\_\_\_  
bajo el número de solicitud de Estados Unidos o  
número de solicitud internacional PCT  
y modificada el día \_\_\_\_\_  
\_\_\_\_\_  
(de ser procedente).

Por este medio declaro que ha revisado y que entiende el contenido de la descripción que antecede, incluso las reivindicaciones, según están modificadas de acuerdo con cualquier modificación arriba citada.

Por este medio reconozco mi deber de divulgar información que sea esencial con respecto a la patentabilidad según se define en el Título 37 del Código de Regulaciones Federales § 1.56.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

#### PREFABRICATED BIOLOGICAL

#### PURIFICATION SYSTEM

the specification of which is attached hereto unless the following box is checked:

was filed on \_\_\_\_\_  
as United States Application Number or PCT  
International Application Number  
and was amended on \_\_\_\_\_  
\_\_\_\_\_  
(if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

[Page 1 of 3]

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(Declaration and Power of Attorney for Patent Application--Spanish Language Declaration (PTO/SB/108)  
[1-17.1]—page 1 of 3)

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## Spanish Language Declaration

Por este medio reclamo prioridad extranjera bajo el Título 35, Código de Estados Unidos, § 119(a)-(d) o § 365(b) de cualquier o cualesquier solicitud(es) de patente o certificado de inventor extranjero(s), o bajo el Título 35, § 365(a) del mismo Código, de cualquier solicitud internacional PCT en que se designa por lo menos un país distinto a los Estados Unidos, dicha(s) solicitud(es) o dicho(s) certificado(s) enumerándose a continuación, y, marcando la(s) siguiente(s) casilla(s), también he identificado cualquier solicitud de patente o de certificado de inventor extranjera que tenga una fecha de presentación anterior a la fecha de la solicitud sobre la cual se reclama prioridad.

## Prior Foreign Application(s)

Solicitud(es) Extranjera(s) Anterior(es)

<u>5026</u>	<u>Costa Rica</u>
(Número)	(Country)
(Número)	(País)
<u>PCT/CR99/00001</u>	<u>PCT</u>
(Número)	(Country)
(Número)	(País)

Por este medio reclamo el beneficio bajo el Título 35, Código de Estados Unidos, § 119(e) de cualquier o cualesquier solicitud(es) provisional(es) de Estados Unidos enumerada(s) a continuación.

None None  
 (Application No.) (Filing Date)  
 (Nº de solicitud) (Fecha de presentación)  
None None  
 (Application No.) (Filing Date)  
 (Nº de solicitud) (Fecha de presentación)

Por este medio reclamo el beneficio bajo el Título 35, Código de Estados Unidos, § 120 de cualquier o cualesquier solicitud(es) de Estados Unidos o, bajo el Título 35, § 365(c) del mismo Código, de cualquier solicitud internacional PCT en que se designan los Estados Unidos, dicha(s) solicitud(es) enumerándose a continuación y, en la medida en que el objeto de cada una de las reivindicaciones de la presente solicitud no hubiere sido divulgado en la solicitud anterior de Estados Unidos o internacional PCT, según lo dispuesto en el primer párrafo del Título 35, Código de Estados Unidos, § 112, reconocio el deber de divulgar información que fuere esencial con respecto a la paternidad, según se define en el Título 37, Código de Regulaciones Federales, § 1.56, que hubiere llegado a suyo disponible entre la fecha de presentación de la solicitud anterior y la fecha de presentación nacional o internacional PCT de la presente solicitud.

None None  
 (Application No.) (Filing Date)  
 (Nº de solicitud) (Fecha de presentación)  
None None  
 (Application No.) (Filing Date)  
 (Nº de solicitud) (Fecha de presentación)

Por este medio manifiesto que todas las declaraciones hechas en la presente en base a mis propios conocimientos son verdaderas y que considero que son verdaderas todas las declaraciones hechas en base al mejor saber y entender; adicionalmente manifiesto que dichas declaraciones se hicieron con conocimiento de que las declaraciones falsas intencionales y similares son punibles por mala o encarcelamiento o ambos, bajo la Sección 1001 del Título 18 del Código de Estados Unidos y que dichas declaraciones falsas intencionales pueden poner en peligro la validez de la solicitud o de cualquier patente concedida en virtud de la misma.

I hereby claim foreign priority under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(e) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

## Priority Not Claimed

Declaro de prioridad no reivindicado28 May 1999 

(Day/Month/Year Filed)

(Día/Mes/Año de presentación)

19 Nov. 1999 

(Day/Month/Year Filed)

(Día/Mes/Año de presentación)

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(e) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

None

(Status) (presente, pendiente, abandonado)  
 (Estado) (presente, en trámite, abandonado)  
None  
 (Status) (presente, pendiente, abandonado)  
 (Estado) (presente, en trámite, abandonado)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR AUTHORIZATION OF ATTORNEY(S) TO ACCEPT AND FOLLOW INSTRUCTIONS FROM REPRESENTATIVE**

The undersigned to this declaration and power of practitioner hereby authorizes the U.S. practitioner(s) named herein to accept and follow instructions from

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as to any actions to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. practitioner(s) and the undersigned. In the event of a change in the person(s) from whom instructions may be taken, the U.S. practitioner(s) will be so notified by the undersigned.

(Added Page to Combined Declaration and Power of Attorney for Authorization of Attorney(s) to Accept and Follow Instructions from Representative [1-24])

09980134-022502

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## Spanish Language Declaration

PODER: Como inventor nombrado, por este medio designo al siguiente abogado o abogados y/o asesores o agentes para que tramiten la presente solicitud y realicen todas las gestiones ante la Oficina de Patentes y Marcas Registradas en relación con la misma: (Indique el nombre y número de registro).

\*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number).

## \*See Below

Envío la correspondencia a:

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Chicago, Illinois, IL 60195  
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 (nombre y número de teléfono)

Send Correspondence to:

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 (name and telephone number)

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Firma del segundo inventor	Second inventor's signature
<i>P. Enrico Bruso</i>	Date 18-12-01
Residencia	Residence
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Ciudadanía	Citizenship
<u>Italy</u>	<u>Italy</u>
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<u>San Francisco de Dos Ríos.</u>	<u>San Francisco de Dos Ríos.</u>
<u>San José, Costa Rica</u>	<u>San José, Costa Rica</u>

(Suministre información similar y firmas del tercer inventor conjunto y siguientes.)

(Supply similar information and signature for third and subsequent joint inventors.)

[Page 3 of 3]

Declaration and Power of Attorney for Patent Application—Spanish Language Declaration (PTO/SB/109)  
[1-17.1]—page 3 of 3

\*      Douglas H. Pauley  
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Kevin D. Erickson  
 Regis. No. 38,736

Charles C. Kinne  
 Regis. No. 31,631

Roland W. Norris  
 Regis. No. 32,799

SCP-110

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.27(a)(1))-INDEPENDENT INVENTOR (A PERSON)

Docket Number  
SCP-110

Applicant or Patentee: Luigi BRUSO et al.

Serial or Patent No.:

Filed or Issued:

Title: PREFABRICATED BIOLOGICAL PURIFICATION SYSTEM

As a below named inventor, I hereby declare that I qualify as an independent inventor (a person) as defined in 37 CFR 1.27(a)(1), for purposes of paying reduced fees to the United States Patent and Trademark Office, with regard to the invention described in:

- the specification filed herewith with title as listed above.
- the application identified above.
- the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.27(a)(1) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.27(a)(2) or a nonprofit organization under 37 CFR 1.27(a)(3).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- no such person, concern or organization exists.
- each such person, concern or organization is listed below.

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.27(g)(2))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Luigi BRUSO

NAME OF INVENTOR



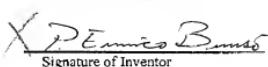
Signature of Inventor

18-12-'01

Date

Pier Enrico BRUSO

NAME OF INVENTOR



Signature of Inventor

18-12-'01

Date

NAME OF INVENTOR

Signature of Inventor

Date